The Sun.

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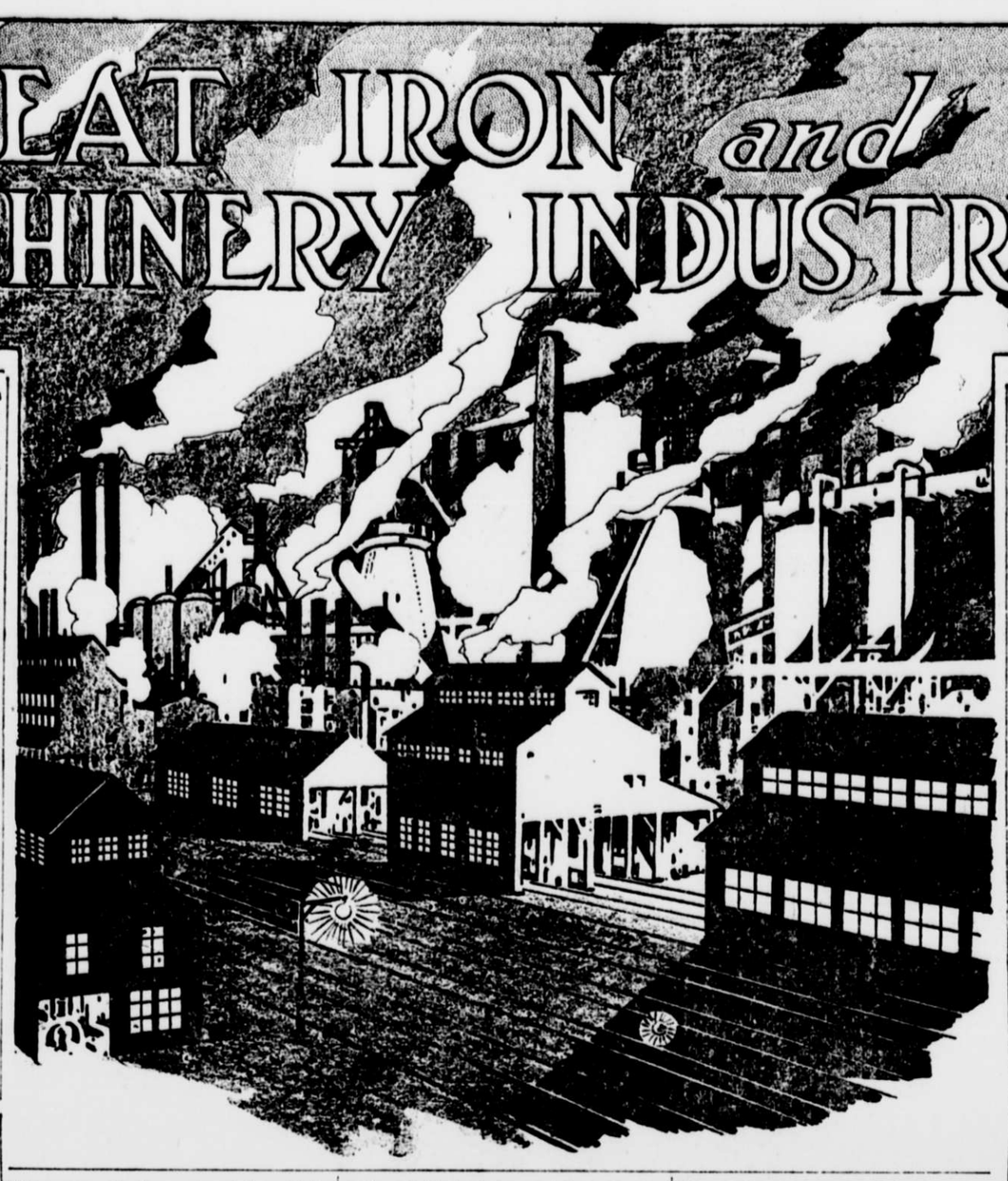
The GREAT IRON and STEEL MACHINERY INDUSTRY



ROMANCE IN THE MAKING OF STEEL

An Industry Titanic in Its Nature and in Its Sudden Growth.

IT IS BUT 40 YEARS OLD

And 'Twas Only in 1846 That Malleable Iron Was Hit Upon.

USE OF THE AIR BLAST

William Kelly, Sitting Before Furnace, Chanced Upon Principle.

IRON ONCE A COSTLY METAL

Ancient Greeks So Found It—Some of the History and Future Possibilities of Steel.

Those who have lived in steel making towns never forget the sight of the great mills in operation at night. The tall chimneys that point their black fingers skyward by day at night turn into wonderful candles, each with its waving, ruddy colored flame flickering against the black sky. The iron sheathed buildings seem to reflect a white glow from every opening, and every window is a spot of light. Now and then a burst of flame from a converter shoots upward, filling the air with glittering sparks. Then a train-load of hot metal creeps through the yard, some of the metal sputtering and glowing and another part darkening to a rich red. If it is a wire mill there is a seemingly endless tube of heated wire in coils travelling along an overhead conveyer. Nearer the rolling mill the coils are very white, but they grow dimmer, until those furthest away from the hot mills are black and invisible.

All of this is a growth almost of the last forty years. At the opening of the civil war it cost about $50,000 to outfit a first class furnace which would keep seventy men busy and turn out a thousand tons of metal a year. After the war the revival of business brought increased orders. Plants were run night and day to fill them. The output doubled and the price of iron went from $18.60 to as much as $73.60 a ton. The demand was for steel and cheap steel. The railroads wanted it, the industrial centres were clamoring for it.

It was William Kelly of Pittsburg and Sir Henry Bessemer, an Englishman, who answered the demand. Kelly's history and the story of his invention is the opening chapter of the book of modern marvels which the steel industry spreads out to the observer. Kelly's father was a landowner near Pittsburg and Kelly was 36 years old when the iron maker first knew he lived. He was then making wrought iron kettles and used a small furnace in which about 1,500 pounds of pig iron were placed between two layers of charcoal. He had to cart his charcoal seven miles at that.

A GREAT DISCOVERY BY CHANCE.

As he was sitting in front of his furnace in 1846 he saw that there was a white place in the molten metal that filled his furnace. He knew that the "finery" had little or no charcoal in it at that moment, merely a good draught of air, and yet the iron was almost white hot. He thought a few minutes and came to a conclusion. In those minutes a new era was born to the steel industry. He concluded that there was no necessity for charcoal, that air itself was fuel, that the oxygen in it had united with the impurities in the iron. He was sure of his ground now and was willing to prove what he had discovered. He invited a number of iron makers from Kentucky to visit him where his plant was. Air was blown through melted pig iron; the cooled iron was made into a horseshoe. He had discovered malleable iron and had given what is considered the first public demonstration of how bessemer steel is made. He called it the "pneumatic process."

In 1851 he built his first converter, a square brick affair four feet high, with a cylindrical chamber with a hole in the bottom for the air blast. Five years later he learned that Henry Bessemer in England had taken out a United States patent for the process. Kelly claimed priority of invention and the United States Patent Office recognized his claim. Then the panic of 1857 came and Kelly sold his patent to his father for $1,000.

Kelly with some thousands of others in the country at that time became a bankrupt, but he always had in mind the great fact of his life, that he had learned something other people didn't know. One day he came to Daniel J. Morrell, the general superintendent of an iron works in Johnstown, Pa., and asked permission to use his facilities for a few experiments. The superintendent promised to give him a corner in the yard, and there Kelly built another converter. When the queer apparatus was completed it excited general curiosity and no little comment from the workers in the mills.

INVENTOR LAUGHED AT AT FIRST.

When Kelly was ready for his first experiment he asked the superintendent for a blast of air and a good one. The engineer in charge of the blowing engine gave such a young tornado that the whole contents of the converter flew into the air in a skyrocket of sparks. They called it "Kelly's fireworks," and it was laughed at for years.

Kelly's next experiment was more successful. The air blast was moderated and it took him half an hour to produce a substance which flattened out could be hammered into a thin plate and was not cast iron. He had proved his point that cold air refines molten iron and does not chill it. When he was more than 70 years old he retired from the iron business and spent his last days quietly in Louisville, Ky.

HOW BESSEMER STARTED.

Mr. Bessemer in England was a coworker in point of time with Kelly. Bessemer had a conversation with Napoleon III., who was then Emperor of France, in which Napoleon complained that the metal which he used for his cannon was expensive and not very good. Bessemer began expriments in London.

"I had very little to unlearn about metallurgy," he is quoted as saying, "and the idea struck me of making malleable iron by introducing air into fluid metal." He met with opposition in England just as Kelly had in America, but succeeded. Now there are more than a hundred bessemer converters in daily use.

The modern converter is an iron pot about twelve feet high swung on an axle in the middle so it can be tilted. Delicate electrical machinery makes this huge instrument as easy to handle as a toy. The ordinary converter holds about 30,000 pounds of molten iron. This is poured in and then the air comes from little holes at the base. From the top of the converter a huge cornucopia of flame bursts out, brilliant with millions of scintillating discs of molten metal. They change from red to yellow, and then they become white.

It is the work of a skilled man to know just when the change is complete. In some makes of converters he watches through a protected opening into the seething mass of hot metal. At the proper time he gives the signal. His assistant presses a lever and the great pot tilts slowly until its contents pour into a ladle and from that ladle are transferred into huge clay receptacles which a small locomotive puts into place. These receptacles form a miniature train and are taken away.

THE PICTURESQUE CAPT. WILLIAM R. JONES.

Another curious figure in the light of the blazing cupola of the steel industry was Capt. William R. Jones, who developed the invention of Kelly and Bessemer and helped put the Carnegie company above its early competitors. As a boy Jones was indifferent to danger or pain. They tell a story that as a boy he cut his finger nail open to see what was underneath. When he was eighteen he ran away from home, married and got his first job in the Cambria works at Johnstown. When the manager of the place died, in 1873, Jones was next in line for promotion. The boss thought he was too irresponsible and promoted another man over his head. The other man insisted that he was not the person for the place and Jones got it.

Andrew Carnegie secured him as superintendent of the new works at Braddock, near Plattsburg. Jones turned out nearly twice as much in the first fifteen weeks that he was there as any one before him had done. A year later he made more steel in a week than the average plant did in six. Jones had the knack of inspiring his workmen and every man strove to do his best for him. A paper by Capt. Jones was read to the British Iron and Steel Institute in 1881 and has sometimes been called "America's Industrial Declaration of Independence." In this paper Jones assigned five reasons for his success: The employment of young and ambitious men; strong but pleasant rivalry between plants; the employment of mixed nationalities; the eight hour day and the use of the most up to date machinery.

REFUSED CARNEGIE'S OFFERS OF WEALTH.

Time and again Carnegie offered to raise his wages or take him into the business. Herbert H. Casson in his "Romance of Steel" relates the following incident:

"Among all the partners and employees of the Carnegie Company Jones earned the most and received the least. This was largely his own fault, as he refused to become a shareholder. 'No, Mr. Carnegie, I'm much obliged,' said he, when he was offered a partnership, 'I don't know anything about business and I don't want to be bothered with it. I've got trouble enough in these works. I'll tell you what you can do. You can give me a hell of a big salary.' 'After this, Captain,' replied Carnegie, 'you shall have the salary of the President of the United States.'"

Jones did not believe in waiting until his machinery was worn out. As soon as there was a newer and better device on the market the old machinery went to the scrap heap and the new was put in its place. Several times he amazed his stockholders by asking permission to smash half a million dollars worth of machinery which was practically new but not of the best.

Jones's death occurred at the Braddock furnaces in 1889. One of the furnaces had been working badly and a squad of men were trying to remedy the defect. Jones was in the front. The furnace broke and its contents fell on the head and shoulders of Jones. The next day he died in the hospital. Five thousand workmen marched to his grave while Andrew Carnegie stood by weeping.

A MOUNTAIN OF LAKE SUPERIOR ORE.

Lake Superior district answered the requirements for more ore and in the spring of 1845 Philo M. Everett of Jackson, Mich., was told by a halfbreed Indian that there was a great mountain of solid iron in the district. Everett went north to Lake Superior with four men and an Indian guide. He found "a mountain 150 feet high of solid ore which looked as bright as a bar of iron just broken."

The Lake Superior ore mines are held to be the last most wonderful of the world's mineral discoveries. Experts say that at the present rate of consumption fifty years will exhaust them.

But iron is not new and its manufacture dates so far back that historians don't care to use figures for it, and those who speak of the glories of to-day frequently contrast them with what has gone before.

IRON IN THE PYRAMIDS.

Four thousand years before Christ there was used in the building of the great pyramid of Gizeh a quantity, small to be sure, of iron, a substance then valuable enough to form an important part of the spoils of war. In 1837, according to the curator of a museum here in New York, a small piece of the iron used in the construction of this pyramid was found by some explorers, who attributed its long life to the very dry climate of Egypt. Other bits of iron have been found under circumstances which indicate great age, thousands of years, and these specimens have been carefully preserved among the other relics of antiquity collected by scientists.

Evidences of large iron works have been found on the Peninsula of Sinai, while the fact that the metal was in use by the Assyrians, Chaldeans and Babylonians of the plains of Mesopotamia ages before the Christian era is pretty well established. That iron was identified with the history of the Hebrews is proven by the words which introduce Tubal Cain in the fourth chapter of Genesis, where he is described as "an instructor of every artificer in brass and iron." The Canaanites fought the Israelites from chariots of iron, and the King of Bashan retired to rest in an iron bed. The head of the spear which Goliath wielded was of iron, its weight, we are told, being "six hundred shekels of old iron."

IRON COSTLY IN ANCIENT GREECE.

The Greeks knew the uses of iron, but scholars gather from the references made to the metal in Homer that it was rare and costly. In the third century the Roman carpenters and masons used iron tools. The people of Spain were makers of iron instruments before the Romans were, and the Romans learned this when their men were cut down by the Spanish swords in the hands of Hannibal's soldiers. When Cæsar invade Britain he found the natives in possession of iron which they had made.

What surprises historians is the small progress that was made in the years that men knew how to forge iron. Some of the primitive methods are still to be found in operation. Explorers in Africa less than fifty years ago described the methods of iron manufacture they found there. "Two men squat over a charcoal fire," the description goes, "and both urge it on with hand bellows and charge it alternately with lumps of charcoal and lumps of iron ore. The result of the day's labor of these two men is a dozen pounds of iron."

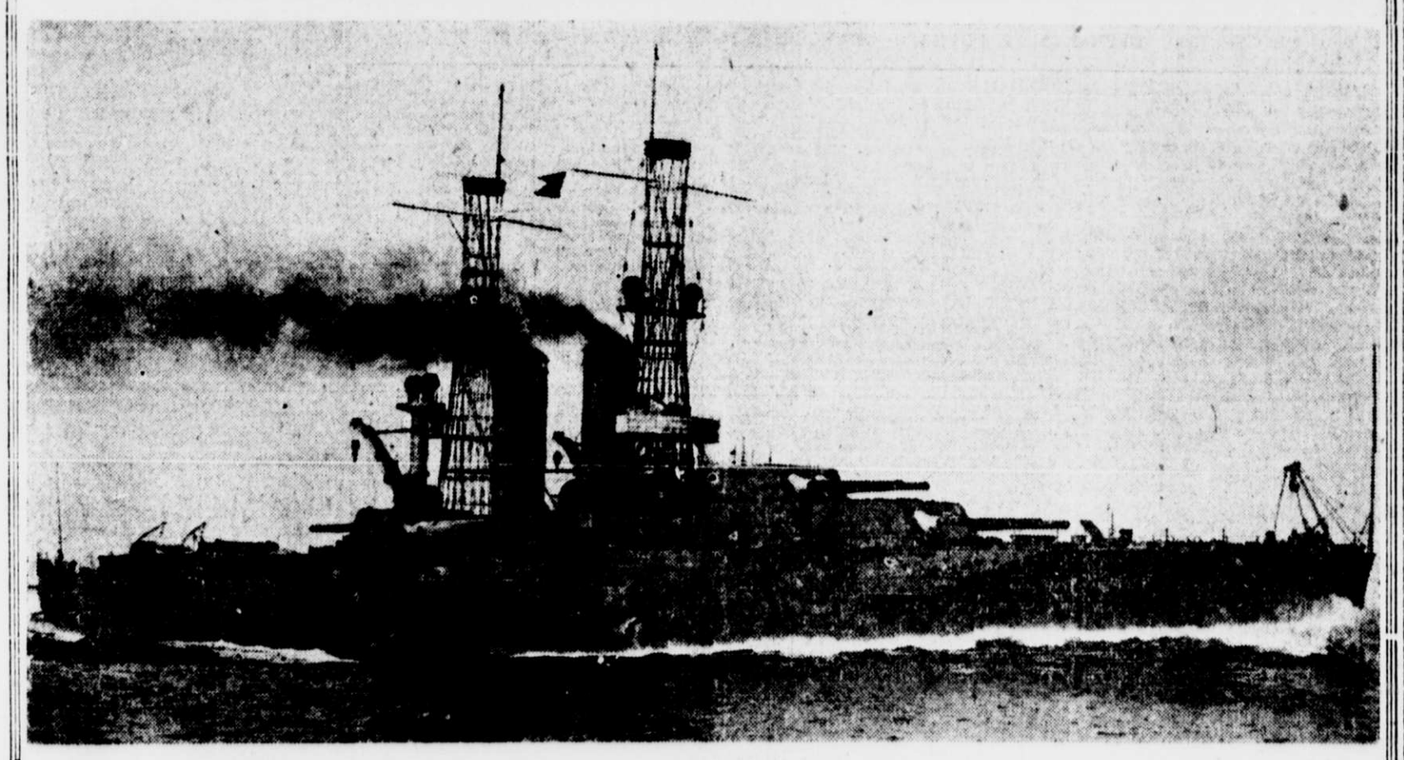
THE FUTURE OF STEEL.

What has the future got for the steel industry? Improvements and growth of the great business have been wonderful. From a small place in the history of the world's needs it now has assumed the foremost. If the present ratio of increase is kept up the five years from 1935 to 1939, statisticians figure, will require as much ore as the two decades from 1880 to 1900. But prophets of an iron famine figure that the iron industry must continue just as it is at present. They forget, steel men say, that we know little of the contents of the earth and are acquainted with small spots of the surface. We know almost nothing of the 5,000 feet beneath that surface and within our reach. The improvements in transportation have brought ore fields thought inaccessible to the doors of the steel industry. Improvements in methods have made former waste valuable assets.

"To sum up once more the wonders of American steel magic," says an author, "let me give a few illustrations. If all our 580 rolling mills were arranged in a circle around Pittsburg the circle would be a hundred miles in diameter. Inside this might be a circle three-quarters as large, composed of our 500 smaller mills and our 3,161 puddling furnaces. The 577 open hearth works would make a third circle, fifty miles across. The 410 furnaces would form a fourth thirty-five miles in diameter and in the centre would be a flaming hub of bessemer converters a mile in circumference pouring out a river of molten steel at the rate of two and a quarter million pounds every hour of the day and night. Put the whole American nation on the scales and, at ninety pounds apiece, they will weigh no more than the iron our furnaces are making every two months. In the last three years we have produced enough to outweigh all the men, women and children in the world."

Carnegie's First Library.

When Andrew Carnegie was a mere lad in the employ of the Pennsylvania Railroad, he with the other boys of the old First Ward, Allegheny, Pa., now the North Side, Pittsburg, had for many years the use of the private library of a Major Anderson. Mr. Carnegie, while speaking at the installation of his libraries, often said that much of his success was due to the influence of the books obtained in this library, and that when he became wealthy the building of the Allegheny Free Library was one of his first acts.



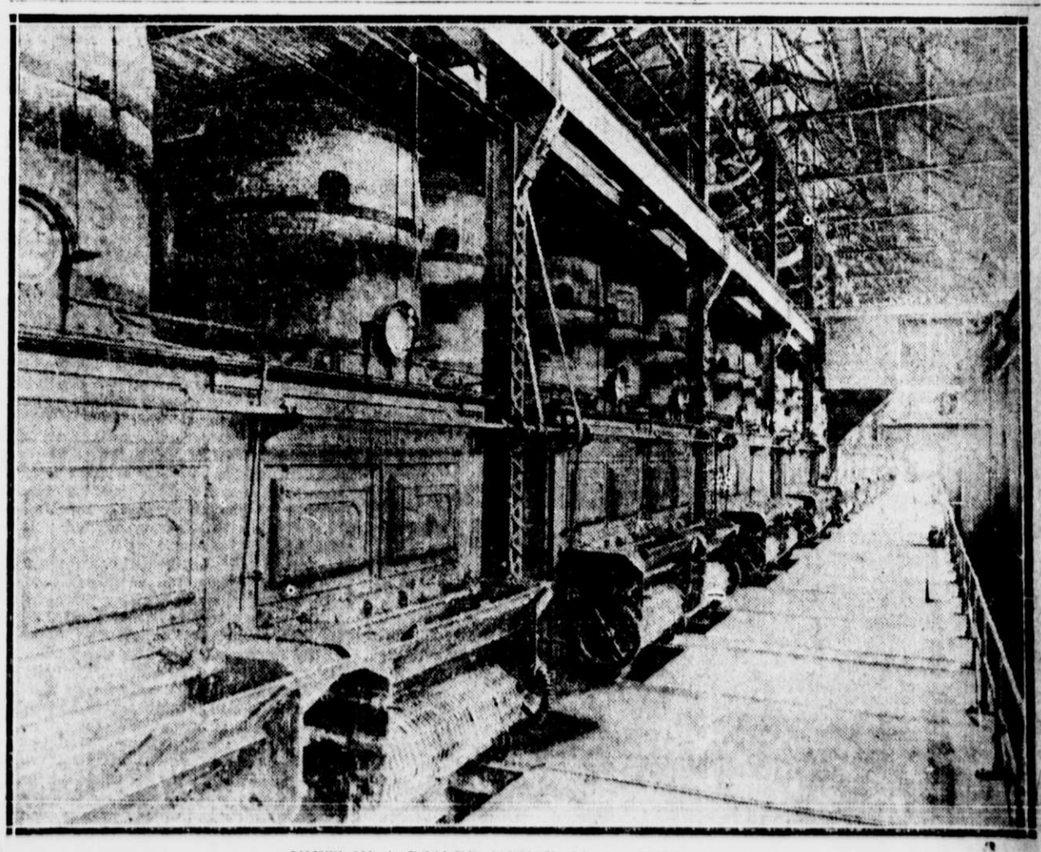
U. S. S. UTAH

PRINCIPAL DIMENSIONS: Length 521' 5"; breadth 88' 2⅝"; draft 28' 6"; displacement 21,825 tons; contract speed 20¾ knots; speed on trial 21.28 knots; Horse Power 28,000; coal capacity 2;500 tons; fuel oil capacity 475 tons; complement 60 officers and 888 men.

ARMAMENT: Ten 12" 50-cal. B. L. R.; Sixteen 5" R. F. G.; two 21" submerged torpedo tubes.

PROPELLING MACHINERY: 28,000 horse power water tube boilers; four Parson's turbines.

BOILERS: By Babcock & Wilcox Co.



VIEW IN A BOILER HOUSE OF A STEEL MILL.